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Vendor Selection and Evaluation : An Activity Based Costing Approach

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Abstract

In this paper we propose an Activity Based Costing approach for vendor selection and evaluation. This system allows us to compute total costs caused by a supplier in a firm's production process, thereby increasing the objectivity in the selection process. We further show that for vendor evaluation purposes the difference between the budgeted and actual total vendor score can be decomposed in a purchaser effect, a supplier effect and a combined effect. We illustrate the Activity Based Costing approach with a case study.

keywords: purchasing, vendor selection, supply management

I. Introduction

In this paper we propose an *Activity Based Costing approach* for selecting and evaluating suppliers (we will interchange the words "vendor" and "supplier"). It is well recognised that suppliers play a crucial role in the production chain and hence in the long term viability of a company. As discussed by Robinson and Timmerman (1987), among others, close working relationships with high performing suppliers are essential in modern production environments. Just-in-time, total quality management and flexible manufacturing systems have become part of the standard vocabulary in management theory.

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Traditionally, vendor selection and evaluation was based on picking the least invoice cost supplier, ignoring other important sources of (indirect) supplier costs like those associated with late delivery times, production breaks, poor quality of delivered goods, etc.. A number of alternative approaches have been suggested to take these other factors into account, called rating models, summarizing several performance indicators into one score. The most simple one is the *Categorical Method*, ranking different vendor characteristics as "good", "satisfactory", "neutral" and "unsatisfactory" (Timmerman, 1986). The most common approach is the *Weighted Point Plan*, which consists of stipulating a number of criteria, giving them different weights and selecting the supplier with the best weighted total score (Wind and Robinson, 1969; Gregory, 1986). A systematic overview of such criteria is given by Dickson (1966) and Weber, Current and Benton (1991). Another technique is the *Analytic Hierarchy Process Method* (Narasimham, 1983) in which relative positions of the suppliers with respect to a given criterion are determined by pairwise comparison. Finally, there exist some methods introducing uncertainty in the performance evaluation model (Soukup, 1987; Thompson, 1990).

The problem with most of the above methods is that the criteria are ad hoc and the ranking could reflect subjectivity: "good" for one manager may be "excellent" for another. A comparison based on monetary costs is therefore much more sensible. Such an attempt, which comes closest to the proposition of the current paper was done by Timmerman (1986), reporting a cost-ratio method in which standard cost analysis is used to evaluate suppliers. A net adjusted invoice cost figure is obtained by the introduction of quality, delivery and service costs associated with the purchase. Timmerman states that the method "may not be equally useful in comparing vendor performance because of the difficulties inherent in translating all aspects of vendor performance into precise cost figures". Traditional product costing methods were designed when direct costs were dominating. However, the introduction of modern production techniques led to an increased importance of overhead costs (Drury, Braund and Tayles, 1992). Simplistic traditional allocation bases as direct labour are no longer sufficient to allocate overhead costs and to calculate precise cost figures for vendor performance evaluation.

In this paper we show that an *Activity Based Costing* (ABC hereafter) approach (Cooper, 1989; Innes and Mitchell, 1993) offers a good alternative to select and evaluate suppliers. Its systematic approach to compute total costs caused by a supplier in a firm's production process improves the objectivity to judge a vendor's performance. The plan of the paper is as follows. In section two we introduce the ABC approach and argue that this approach increases the objectivity in the vendor selection process. We also give a case study as an illustration. In the third section we show how the ABC system can be used to evaluate a supplier. We distinguish between a supplier effect, a purchaser effect and a combined effect. Section four is a concluding section.

2. ABC and Vendor Selection

The ABC system consists of several steps (Innes and Mitchell, 1993). In a first step a company's most significant activities are identified (Brimson,1991). In a second step overhead costs associated with each of these activities are determined. Then factors determining the cost of an activity are ascertained and are referred to as cost drivers or to quote Drury (1992) a cost driver "is used to describe the events or forces that are the significant determinants of the cost of these activities". Finally, overhead costs per unit cost driver (cost driver rate) are applied to cost objects.

Most applications of the ABC system are associated with the hierarchical structure of activities and cost drivers and consist usually of five levels: unit level, batch level, product level, facility level and customer level activities and cost drivers (Kaplan, 1990). ABC techniques have been applied to support new approaches to pricing decisions, profitability analysis, internal performance measurement and cost management. However, there is little discussion about the use of ABC in vendor selection and evaluation.

Formally, the total vendor cost may be expressed as the sum of all shortcomings that cause extra costs or

$$S_i^B = (p_i - p^{\min}) \times q + \sum_j c_j^B \times D_{ij}^B \qquad (1)$$

where

S_i^B = budgeted score of vendor i

p_i = selling price per unit of vendor i

p^{min} = selling price per unit of the cheapest vendor

q = units purchased

c_j^B = budgeted cost per cost driver j in the purchasing company

D_{ij}^B = budgeted units of cost driver j in the purchasing company caused by vendor i.

The company will choose that vendor for which (1) is minimized. A first important component of (1) is the difference between the total selling price of supplier i and that of the price of the cheapest supplier (p_i - p^{min}). A second part of the total cost of vendor i consists of the budgeted internal production costs caused by vendor i ($\Sigma_j c_j^B \times D_{ij}^B$). Thus besides least invoice costs supplementary costs caused by for instance quality, delivery and service problems are taken into account for supplier selection.

There are several advantages to use the ABC system for vendor selection and evaluation, not only for the purchasing company but also for the vendor as well as for the relationship between the purchasing company and the vendor. For the *purchasing company* the ABC system allows to quantify the internal production problems caused by a vendor and therefore gives an objective measure for the criteria that traditionally were considered as non-financial. Secondly, it gives a solution to the multi-objective optimization problem (minimizing invoice cost, delivery time, maximizing quality, service after sales, etc.) by comparing absolute cost figures (S_i^B) (Weber and Current, 1993). Thirdly, the system allows to identify the relative importance of the different cost components which allows the company to design strategies to reduce the different cost driver rates c_j's, thereby increasing efficiency. Similarly, the purchasing company may attempt to influence budgeted units of cost drivers D_{ij} by reducing or eliminating some of the activities.

The *vendor* benefits from the ABC system for it provides an objective indication of customer's satisfaction and the importance of the different criteria involved in the purchasing process. By evaluating the customer's feedback the vendor may be forced to review its strategy. A final advantage is the improvement of the *relationship between*

vendor and purchaser. Modern production philosophies emphasize the importance of a close relationship between the purchaser and a few reliable suppliers. Knowledge of the several criteria and their relative importance gives the vendor an incentive to reduce his score. Since both parties have the same incentive, there is scope for developing inter-organizational cost management systems.

Case study

Rovapo Limited is a medium sized company operating in a just-in-time environment. Purchasing contracts specify strong quality requirements. Quality control is transferred to the supplier. A delivered product that does not conform with quality standards causes a production stop. Consequently, the product is wasted and looses its sales value. The wasted product is replaced by the supplier when delivering the next order.

A delivery arriving too late causes extra costs to Rovapo Limited: Production has to be rescheduled to avoid complete stoppage, implying a one day delay in the planned production. During this period another product will be manufactured. Thus a one day delay in supplying the goods causes one extra planning activity and two setups. Each supplementary day gives rise to an extra planning activity.

In addition to the timing of deliveries, the delivered quantity is an important criterion for Rovapo Limited. A breakdown may be caused by a shortage of delivered goods. The production process has to be reinstalled for every shortage in stock. A planning activity, two set-ups and a supplementary reception of delivered goods (with an additional invoice) are necessary.

The relevant activities in the ABC vendor selection model are planning of a production order, reception of delivered goods, production process stop, setting up of the machinery and administration. The cost drivers (D_j) and cost driver rates (c_j) associated with these activities are listed in table 1.

Table 1: Cost drivers and cost driver rates for Rovapo

activity	cost driver	cost driver rate
planning	production order	£ 600 per order
reception	delivery	£ 500 per delivery
production stop	stop	£ 250 per stop
setting up	setup	£ 1,250 per setup
administration	invoice	£ 300 per invoice

After the obvious elimination of some potential suppliers for 100 orders of 50 parts each (thus 5000 units in total), three selected companies are studied in more detail: Lincon, Malsey and Tubar. Lincon offers a good price - £100 per unit - and has an excellent quality and delivery reputation. Malsey offers the lowest invoice price - £98 per unit - but has a poor reputation for quality and delivery requirements. Finally, Tubar is the most expensive supplier - £103 per unit - but is known for good quality and just-in-time delivery. Table 2 reports the budgeted delivery and quality performances.

Table 2: Vendor's budgeted delivery and quality performance

performance	Lincon	Malsey	Tubar
exceeded delivery date	5 orders	5 orders	3 orders
quantity problems	3 orders	8 orders	6 orders
quality problems	100 units	130 units	80 units

In table 3 we give the total cost and its components, based on (1), for the three suppliers Recall that these outcomes are associated with the cost drivers in the following way: an exceeded delivery date is associated with two new setups and one new production planning, quantity problems are associated with a planning activity, two setups and an extra reception of delivered goods, and quality problems are associated with one production stop.

Substitution in equation (1) gives in Lincon's case: 2×5000 + 1,250×2×5 + 600×3 + 1,250×2×3 + 500×3 + 250×100 = 62,200. It is clear that Lincon has the lowest total score of budgeted extra costs and hence Lincon is chosen as the preferred supplier.

Table 3: Supplier's scores

costs caused by	Lincon	Malsey	Tubar
exceeded delivery date	15,500	15,500	9,300
quantity problems	10,800	28,800	21,600
quality problems	25,000	32,500	20,000
administration	900	2,400	1,800
price difference	10,000	0	25,000
score	62,200	79,200	77,700

3. ABC and Vendor Evaluation

In this section we propose an ABC system as in section 2 to evaluate ex post performance of the selected supplier(s). This evaluation may lead to reviewing the initial choice in the next order round.

We start with equation (1) and substitute the budgeted costs and units with the actual ones (denoted by superscript A),

$$S_i^A = (p_i - p^{\min}) \times q + \sum_j c_j^A \times D_{ij}^A \qquad (2)$$

Subtracting (1) from (2) gives the difference between the budgeted and actual score or

$$S_i^A - S_i^B = \sum_j (c_j^A \times D_{ij}^A - c_j^B \times D_{ij}^B) \qquad (3)$$

By manipulating equation (3) we obtain

$$S_i^A - S_i^B = \sum_j (c_j^A - c_j^B) \times D_{ij}^B + \sum_j (D_{ij}^A - D_{ij}^B) \times c_j^B + \sum_j (c_j^A - c_j^B)(D_{ij}^A - D_{ij}^B) \qquad (4)$$

The first term in (4) is a purchaser effect, the second term is a supplier effect and the final term is a combined effect. We will discuss them in some more detail next.

The *purchaser effect,* $PE = \Sigma_j(c_j^A - c_j^B) \times D_{ij}^B$, refers to factors which allow the purchasing company to improve its efficiency by reducing its cost driver rates c_j. In doing so, the vendor's score will improve without necessarily improving vendor performance. A vendor can never be held responsible for the difference between actual and budgeted cost driver rates and therefore the purchaser effect has to be eliminated for vendor evaluation purposes. In the appendix we consider a possible manipulation of D_j by the purchasing company, for instance by revising its planning procedure.

The *supplier effect,* $SE = \Sigma_j(D_{ij}^A - D_{ij}^B) \times c_j^B$, refers to the difference between actual and budgeted use of cost drivers for which the supplier is responsible since he can potentially affect the cost drivers. Actions related to just-in-time delivery, delivered quantity and quality of the products can seriously affect the supplier effect and hence vendor performance.

Finally, the *combined effect,* $CE = \Sigma_j(c_j^A - c_j^B) \times (D_{ij}^A - D_{ij}^B)$, refers to the difference in costs that cannot be uniquely attributed to either the supplier or the purchaser. Including this effect in the purchaser and/or supplier effect is not theoretically correct.

Case study continued

We will illustrate the three effects just discussed for the Rovapo case. In the previous section we showed how we arrived at selecting Lincon as best supplier for the total order. Ex post, the actual cost driver rates turned out to be £550 for a production order, £520 for a delivery, £230 for a stop, £1,250 for a setup and £300 for an invoice. With respect to the

actual performance of the supplier, the following information was gathered. Four deliveries arrived too late. There was a shortage of delivered goods for four other orders and 105 products did not compile with quality standards. Evaluating Lincon using (2) results in the figures reported in table 4.

Table 4: Lincon's evaluation

costs	budgeted ($c_j^B \times D_{ij}^B$)	adjustment 1 ($c_j^A \times D_{ij}^B$)	adjustment 2 ($c_j^B \times D_{ij}^A$)	actual ($c_j^A \times D_{ij}^A$)
exceeded delivery date	15,500	15,250	12,400	12,200
quantity problems	10,800	10,710	14,400	14,280
quality problems	25,000	23,000	26,250	24,150
administration	900	900	1,200	1,200
price difference	10,000	10,000	10,000	10,000
score	62,200	59,860	64,250	61,830

The second column in table 4 gives the budgeted score used to select Lincon (as in table 3). Actual costs, based on the actual performance of Rovapo and Lincon are presented in the final column. Adjustment 1 gives the vendor's score given the actual performance of the purchasing company and the budgeted performance of the supplier. The purchaser effect can be derived by comparing the budget column with the adjustment 1 column, implying a total purchasing effect of £ -2,340. This means that Rovapo is responsible for a cost saving of £ 2,340. The purchaser effect for the different components can easily be derived from table 4.

The fourth column, adjustment 2, measures the actual supplier performance for budgeted cost driver rates. The supplier effect can be obtained from comparing column two with column four and is equal to £2,050. In other words, the supplier causes a supplementary cost of £2,050 (due to quantity and quality problems), despite a decrease in the total score.

Finally, the combined effect resulting from differences between actual and budgeted

performance of both parties is equal to £ -80 since the combined effect is simply the sum of the budgeted and actual score minus the sum of adjustment 1 and 2. Thus an extra cost of £ 80 cannot be uniquely attributed to the supplier nor the purchaser.

4. Conclusion

In this paper we proposed an *Activity Based Costing approach* for assessing vendor relationships, in particular vendor selection and evaluation. The main advantage of the ABC approach over other commonly used methodologies exists in arriving at objective cost measures in a systematic way. Recent trends in cost and management accounting allow to define activities and to determine cost drivers and cost driver rates for a given company.

Vendor selection in the ABC system occurs by choosing the supplier who minimizes the total additional costs associated with the purchase decision. These include price differentials and supplementary budgeted internal production costs caused by the supplier. Vendor evaluation is done by comparing budgeted and actual scores after delivery of the products. To arrive at an objective performance measure we split the total score difference in a purchaser effect, a vendor effect and a combined effect. The combination of vendor selection and evaluation makes the ABC system a useful concept to improve the purchaser-vendor long term relationship.

The proposal developed in this paper was concerned with selecting the best supplier for a given order. An extension of the approach could deal with selecting several suppliers for several orders as in Akinc (1993) and Weber and Current (1993). Furthermore, the ABC approach could also be used to assist a company in choosing to produce internally or to buy externally (Heizer and Render, 1991). A third application exists in revising traditional performance measures to evaluate a company's purchasing manager. Finally, the determination of transfer prices could be affected by the ABC approach. A different actual or budgeted score S_i for internal and external suppliers could influence cost based or market based transfer prices.

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Appendix I. Extended evaluation model

The difference between actual score and budgeted score is given in (3). The *purchasing company* can ameliorate its efficiency and reduce its costs by influencing cost driver rates c_j or by manipulating its activities D_j. The purchaser effect (PE) is caused by a difference in cost driver rate (purchaser cost effect PCE), a manipulation of the activities performed in the company (purchaser activity effect PAE) or a combination of these two (combined purchaser effect CPE). These effects can be formulated in the following way. The purchaser cost effect reduces to the total purchaser effect in the case the company is unable to influence D_j.

$$PCE = \sum_j (c_j^A - c_j^B) \times D_{ij}^B$$

The purchaser activity effect equals

$$PAE = \sum_j (D_{ij}^A - D_{ij}^{A'}) \times c_j^B$$

The notation $D_{ij}^{A'}$ stands for the actual units of cost driver j in the purchasing company caused by supplier i, when the supplier's performance remaines unchanged. The combined purchaser effect is given by

$$CPE = \sum_j (c_j^A - c_j^B) \times (D_{ij}^A - D_{ij}^{A'})$$

The selected *supplier* also influences the difference between actual and budgeted score. The supplier is responsible for the difference between actual and budgeted use of cost drivers. The supplier effect is equal to

$$SE = \sum_j (D_{ij}^{A'} - D_{ij}^B) \times c_{ij}^B$$

A *combination of purchaser and supplier actions* gives rise to an effect that can not be attributed to one of the parties involved. This combined effect reduces to

$$CE = \sum_j (c_j^A - c_j^B) \times (D_{ij}^{A'} - D_{ij}^B)$$

It can be easily checked that the sum of all effects considered equals the total difference.